NON-PUBLIC?: N
ACCESSION #: 9204280011
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Millstone Nuclear Power Station Unit 3 PAGE: 1 OF 05

DOCKET NUMBER: 05000423

TITLE: Reactor Trip Due to Switchyard Relay Malfunction
EVENT DATE: 06/09/91 LER #: 91-014-01 REPORT DATE: 04/20/92

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(i) and 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Jeffry A. Langan, Senior Engineer, TELEPHONE: (203) 447-1791 Ext. 5544

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: EL COMPONENT: RLY MANUFACTURER: W120
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At 1125 hours on June 9, 1991, with the plant at 100% power in Mode 1, at 2250 psia and 587 degrees Fahrenheit, a reactor and subsequent turbine trip occurred. The trips were due to a phase to ground fault on a 345 kilovolt (KV) system transmission line (external to the plant) in combination with a faulty switchyard pilot wire relay. The pilot wire relay scheme protects the 345KV transmission zone from the main generator output transformer to the switchyard tie breakers (which connect the plant to the distribution system transmission lines). These faults caused station switchyard breakers to open and resulted in Unit 3 load rejection schemes operating to initiate the trips.

The root cause of the trip was a loose restraint tap on the switchyard pilot wire relay. The tap screw was broken and was not completely tightened on the lug of the tap wire. The loose tap resulted in an open circuit and caused the pilot wire relay to actuate incorrectly to the

transmission line fault. The cause of the broken tap screw could not be determined. A Feedwater Isolation and Auxiliary Feedwater actuation occurred as expected following a trip. No other Engineered Safety Feature signals were initiated and the event posed no significant hazard to the health and safety of the public. The broken tap screw and affected wiring were repaired, and the pilot wire relay was returned to service.

END OF ABSTRACT

I. Description of Event

At 1125 hours on June 9, 1991, with the plant at 100% power in Mode 1, at a pressure of 2250 psia and a temperature of 587 degrees Fahrenheit, a reactor trip and subsequent turbine trip occurred. The trips were due to a phase to ground fault on a 345 kilovolt (KV) distribution system transmission line (external to the plant) in combination with a faulty switchyard pilot wire relay. The pilot wire relay scheme protects the 345KV transmission zone from the main generator output transformer to the switchyard tie breakers (which connect the plant to the distribution system transmission lines). These faults caused the station switchyard tie breakers to open and resulted in the Unit 3 load rejection schemes operating to initiate the plant trip. Operation of the load rejection schemes caused a fast close signal to be sent to the turbine control valves and combined intercept stop valves. The fast close signal dumps control oil pressure to the turbine control valves which generates a reactor trip from turbine trip signal. As the reactor was greater than the P-9 setpoint of 35% power the reactor trip signal was processed by the Solid State Protection System (SSPS) and the reactor was tripped. A turbine trip signal was generated by the reactor trip, and the turbine stop valves were tripped close.

Normally, electrical power to internal plant loads is supplied from either the main generator or the switchyard via the Normal Station Service Transformers (NSST). Since both supply sources to the NSST were unavailable following the event, internal plant loads were automatically, aligned to the Reserve Station Service Transformers (RSST). By design, the non-vital 4.16KV buses were isolated from both the NSST and RSST, and then the RSST supply breakers for the 4.16KV safety related (vital) busses were closed. This occurred within 620 milliseconds of the loss of the NSST. the transfer to the 6.9KV RSST which supplies the reactor coolant pumps and condensate pumps) occurred within 80 milliseconds. All 6.9KV loads

continued to run except that the "A" Condensate Pump tripped and caused the standby "B" Condensate Pump to start. The reactor trip response procedures were immediately initiated. and power to the non-safety related 4.16KV busses was restored within 29 minutes of the trip. The indicated cause of the "A" Condensate Pump trip was overcurrent. An inspection of the breaker and motor identified no damage had occurred. After the inspection, the pump was satisfactorily started and operated. Off-site power was restored to the NSST at 1530 hours. The 6.9 KV busses were shifted to the NSST at 1644 hours, and the 4.16KV busses were shifted to the NSST at 1655 hours.

At the time of the trip, operators verified that the Reactor Trip and Bypass Beakers were open, that all control rods were fully, inserted, and that neutron flux was decreasing. A Feedwater Isolation actuation occurred due to low Average Reactor Coolant System temperature following the trip. An Auxiliary Feedwater actuation occurred as a result of a steam generator low-low level signal. These are normal responses following a trip from 100% power. No additional Engineered Safety Features were required or initiated. The steam dump system actuated as designed on a turbine trip by dumping steam to the main condenser. However, on low condenser vacuum, the steam dump system stopped dumping steam when the C-9 (Condenser Available for Steam Dump) interlock de-energized. The C-9 interlock de-energizes on low condenser vacuum, closing the steam dump valves and preventing them from reopening. Because of damage to instrument tubing, the condenser pressure switches were approximately 40 seconds late in sensing the low vacuum condition and de-energizing C-9. This delay in the steam dumps closing aggravated the pressure and temperature transient experienced in the condenser. The plant was stabilized at approximately 1216 hours based on recovery of electrical power to the non-safety related busses and placement of the secondary system in a controlled configuration.

The original plant design initiated a fast (i.e., within 6 cycles) transfer of all plant 4.16KV loads to the RSST on a loss of the NSST. The 4.16KV fast transfer was subsequently deleted in order to preclude exceeding electrical limits on safety, related equipment. LER 88-026 discusses the basis for modifying the 4.16KV transfer scheme. The delayed transfer of safety related 4.16KV loads to the RSST functioned satisfactorily to maintain operation of equipment vital to plant safety. However, the loss of non-safety related equipment impacted the recovery of the secondary plant. The loss of

circulating water pumps caused a loss of condenser vacuum. A pressure increase resulted in the rupturing of one condenser blowout discs, and an increase in condenser hotwell temperature to approximately 175 degrees Fahrenheit. The delay in the C-9 interlock dropping out contributed to the overheating of the condenser and the rupturing) of the condenser blowout discs. Once non-safety related power was restored, equipment was returned to normal. However, the circulating, pumps were not started until condenser hotwell temperature had cooled significantly in order to avoid thermal shock to the condenser.

Technical Specification (TS) 3.8.1.1 requires verification of Emergency Diesel Generator operability within one hour of a loss of either offsite power source. This requirement was not fulfilled while operators were in the process of restoring power and following the emergency procedures associated with the event.

II. Cause of Event

The root cause of the trip was a loose restraint tap on the switchyard 87PWY pilot wire relay. The tap screw was broken in the threaded hole and was not completely tightened on the lug of the tap wire. The loose tap resulted in an open circuit and caused the mis-operation of the pilot wire relay following the transmission line fault. The cause of the broken tap screw could not be determined.

The pilot wire relay is designed to actuate only on faults which occur between the main generator output transformer and the two 345KV switchyard output breakers. Electrical faults that occur within this zone actuate the pilot wire relay and cause a Unit 3 trip. Faults which occur outside the zone protected by, the pilot wire relay scheme, such as the fault which occurred in this event, should not result in pilot wire relay actuation. External faults are isolated through a selective tripping scheme that may result in one of the Unit 3 switchyard tie breakers tripping, but will still enable Unit 3 to remain on line feeding the switchyard via the other tie breaker.

III. Analysis of Event

This event is being reported in accordance with 10CFR50.73(a)(2)(iv), any event or condition that resulted in manual or automatic actuation of any Engineered Safety Features (ESF) including the Reactor Protection System. An immediate notification was made in accordance with 10CFR50.72(b)(2)(ii).

All protection and safety systems functioned as designed as a result of the reactor trip. A Feedwat
r Isolation and Auxiliary Feedwater
ESF actuation occurred as expected following a trip. No other ESF signals were initiated and the event posed no Significant hazard to the health and safety of the public. The loss of non-vital power for approximately 29 minutes presented difficulties in returning the plant secondary systems to a normal shutdown condition as described in Section 1. An inspection was performed on equipment that could be affected by the excessive temperatures; no damage was observed. Secondary plant equipment was returned to normal operation, and the unit was returned to power.

As vital power was immediately shifted from the NSST to the RSST, the Emergency Diesel Generators (EDG) were not required to start automatically. Technical Specification (TS) 3.8.1.1 requires EDGs to be started within one hour of a loss of either offsite power source. This requirement was not met. The loss of non-safety, related power resulted in plant operation in accordance with the Emergency Operating Procedures (EOPs) for an extended period. The EOPs frequently verify the safety related busses are energized. After the plant was placed in a stable condition and power was restored to the non-vital bus, a TS review was conducted. Operators were making preparations to run EDG surveillances when power was restored to the NSST. The Millstone Unit 3 Emergency Diesels have demonstrated very high reliability to start on demand. In the last three years there have been no "failures to start" with the testing criteria specified in Regulatory Guide 1.108. Therefore, the safety significance of not testing per the Technical Specification action statement was minimal.

IV. Corrective Action

The broken tap screw and affected wiring were repaired, and the pilot wire relay was returned to service.

Although safety systems responded as designed to the trips and to a loss of the NSST, this event is considered to be a significant transient to Unit 3 because of the stress placed on the secondary, non-safety, related systems. A design review has been conducted to address the problems associated with the loss of circulating water pumps and the attendent high temperatures experienced in the secondary systems. As a result of this review additional procedural

guidance has been incorporated in the Reactor Trip Response procedure to direct the control room operators to close the Main Steam Isolation Valves (MSIVs) in the event of a loss of power to the non-vital 4.16 KV buses, as well as shutdown the condenser air removal system, and trip the condensate pumps. This will serve to limit the energy being dumped to the condenser, reduce heat transfer from the feedwater heaters, and prevent condenser inventory from being pumped throughout the secondary system.

As corrective action to the late de-energization of the C-9 interlock, tubing for the C-9 pressure switches has been increased in size from 1/2 inch to 3/4 inch. The tubing run has also been straightened out to eliminate potential loop seals which could have delayed de-energization of C-9 interlock.

V. Additional Information

This is considered to be an isolated event as no LERs have been submitted on any similar electrical fault which resulted in a plant trip. An NPRDS search was conducted with the following conditions:

* Component -- Relay

* Manufacturer -- Westinghouse Electric Corp./Hagan

* Model Numbers -- HCB1/HCB-1

There were no records retrieved from NPRDS that met these search conditions.

The pilot wire relay is a Type HCB-1 relay manufactured by Westinghouse Electric Corporation. It measures the difference between current that is produced by the Unit 3 output transformer and the current delivered to the site switchyard busses via the two Unit 3 switchyard breakers. A sufficiently large difference between the transformer input current and the breaker(s) output current will isolate the fault through selective tripping of both switchyard breakers and the generator output breaker. This results in the generation of a Power Load Unbalance signal, which initiates a fast closure of the turbine control valves and the combined intercept stop valves. The fast close signal dumps control oil pressure from the turbine control valves, which is interpreted by the Reactor Protection System as a turbine trip. As the reactor was greater than 35% power, the reactor trip signal was processed by the Solid State Protection System (SSPS) and the reactor was tripped. A turbine trip signal was generated by the reactor trip, and turbine

stop valves were tripped close. A transfer of electrical power from the NSST to the RSST occurred as a result of low voltage on the vital 4.16 KV electrical busses.

EIIS CODES

System Components

Main Generator Relay -- RLY
Output Power System -- EL

General Offices * Selden Street, Berlin Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203)665-5000
NORTHEAST UTILITIES
NU The Connecticut Light And Power Company
Western Massachusetts Electric Company
Holyoke Water Power Company
Northeast Utilities Service Company
Northeast Nuclear Energy Company

Re: 10CFR50.73(a)(2)(iv) &
10CFR50.73(a)(2)(i)

April 20, 1992
MP-92-406

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Reference: Facility Operating License No. NPF-49
Docket No. 50-423
Licensee Event Report 91-014-01

Gentlemen:

This letter forwards Licensee Event Report (LER) 91-014-01 which is being submitted as a revision to LER 91-014-00 to include additional corrective action and enhance the description of the event. LER 91-014-00 was

submitted pursuant to 10CFR50.73(a)(2)(iv), any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS), and 10CFR50.73(a)(2)(i) any operation or condition prohibited by the plant's Technical Specification.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

Stephen E. Scace
Director, Millstone Station

SES/JAL:ljs

Attachment: LER 91-014-01

cc: T. T. Martin, Region I Administrator
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2 and 3
V. L. Rooney, NRC Project Manager, Millstone Unit No. 3

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